Idaho Disease BULLETIN

Special Edition: Mass Exposures to Chemicals

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Recognition of Chemical Exposures

Physicians and other health care providers have a vital role in recognizing epidemiologic clues and clinical patterns of illness associated with the covert release of a chemical agent. The following clues might suggest the release of a chemical agent.

1) *Rapid onset of symptoms after exposure to potentially contaminated medium.* Many chemicals have a latency period of less than one hour after ingestion before signs and symptoms are seen, whereas symptoms from enteric infection generally develop half a day or longer after ingestion of contaminated food.

2) *An unusual increase in the number of patients seeking medical care for potential chemical-related illness, either clustered on the same day or spread out over time.* Querying your clinic's records for the number of like diagnoses in a similar time period may help you determine if you have a higher number of cases than usual.

3) *Clustering of illness among people who are found to have a common exposure, such as drinking water or eating food from the same source*. Taking a good history of food and beverage consumption, event attendance, and recent travel before onset of illness is necessary to find common exposures. Your local health department will investigate histories of patients having a reportable disease, which includes extraordinary occurrence of illness, such as a case included in a syndromic cluster with or without an identified etiologic agent.

   The following incident from 2003 illustrates how clues #1–3 above led to detection of an intentional chemical contamination. Several persons having signs and symptoms of gastroenteritis arrived at a local emergency department after 16 become acutely ill at a church bake sale in New Sweden, Maine; at one point, five were in the ICU for hypotension, an atypical presentation for foodborne gastroenteritis. Epidemiologic investigation suggested coffee as the source of illness. The state public health laboratory in Maine detected high levels of arsenic in the coffee and in the patients.

4) *Unexplained deaths among young or healthy people*.
   For example, during November 1995 through July 1996, 109 previously healthy children were admitted to the University hospital in Port-au-Prince, Haiti, for acute renal failure. No children had been admitted for acute renal failure in the previous five years. Investigators determined that use of a locally manufactured acetominophen syrup containing diethylene glycol-contaminated glycerin was responsible for the outbreak.

More inside:

5) *Unexplained death of plants or animals.*

6) *Emission of unexplained odors by patients.* For example, the smell of garlic suggests arsenic or organophosphates, the smell of tobacco suggests nicotine, a rotten egg odor suggests hydrogen sulfide, and the smell of freshly cut hay suggests phosgene; however, not every exposed patient will have a characteristic odor.

7) *A syndrome suggesting a disease associated commonly with a known chemical exposure*.

See table below for selected clinical syndromes and possible chemical etiologies.

Table Source: Centers for Disease Control and Prevention. Recognition of Illness Associated With Exposure to Chemical Agents— United States, 2003. MMWR 2003;52:938-940.

TABLE. Selected* clinical syndromes and potential chemical etiologies

Category	Clinical syndrome	Potential chemical etiology
Cholinergic crisis	• Salivation, diarrhea, lacrimation, bronchorrhea, diaphoresis, and/or urination • Miosis, fasciculations, weakness, bradycardia or tachycardia, hypotension or hypertension, altered mental status, and/or seizures	• Nicotine† • Organophosphate insecticides† — decreased acetylcholinesterase activity • Carbamate insecticides • Medicinal carbamates (e.g., physostigmine)
Generalized muscle rigidity	• Seizure-like, generalized muscle contractions or painful spasms (neck and limbs) and usually tachycardia and hypertension	• Strychnine — intact sensorium
Oropharyngeal pain and ulcerations	• Lip, mouth, and pharyngeal ulcerations and burning pain	• Paraquat† — dyspnea and hemoptysis secondary to pulmonary edema or hemorrhage; can progress to pulmonary fibrosis over days to weeks • Diquat • Caustics (i.e., acids and alkalis) • Inorganic mercuric salts • Mustards (e.g., sulfur)
Cellular hypoxia	• Mild: nausea, vomiting, and headache • Severe: altered mental status, dyspnea, hypotension, seizures, and metabolic acidosis	• Cyanide† (e.g., hydrogen cyanide gas or sodium cyanide) — bitter almond odor§ • Sodium monofluoroacetate (SMFA)† — hypocalcemia or hypokalemia • Carbon monoxide • Hydrogen sulfide • Sodium azide • Methemoglobin-causing agents
Peripheral neuropathy and/or neurocognitive effects	• Peripheral neuropathy signs and symptoms: muscle weakness and atrophy, "glove and stocking" sensory loss, and depressed or absent deep tendon reflexes • Neurocognitive effects: memory loss, delirium, ataxia, and/or encephalopathy	• Mercury (organic)† — visual disturbances, paresthesias, and/or ataxia • Arsenic (inorganic)† — delirium and/or peripheral neuropathy • Thallium — delirium and/or peripheral neuropathy • Lead — encephalopathy • Acrylamide — encephalopathy and/or peripheral neuropathy
Severe gastrointestinal illness, dehydration	• Abdominal pain, vomiting, profuse diarrhea (possibly bloody), and hypotension, possibly followed by multisystem organ failure	• Arsenic† • Ricin† — inhalation an additional route of exposure; severe respiratory illness possible • Colchicine • Barium — hypokalemia common

* Not intended as a complete differential diagnosis for each syndrome or a list of all chemicals that might be used in a covert chemical release.
† Potential agents for a covert chemical release based on historic use (i.e., intentional or inadvertent use), high toxicity, and/or ease of availability.
§ Unreliable sign.

Medical care providers are often taught the principle of Occam's Razor (*i.e.*, one cause typically explains the entire clinical picture); however, with malicious poisoning, multiple agents may be introduced into the environment. Symptomatic treatment may be required initially; considering a wider differential and making use of available screening tests may be prudent. In general, treating the clinical syndrome rather than treating for a specific agent may be the most pragmatic approach to the treatment of illness caused by chemical exposures. A treatment algorithm that you might find useful, "Emergency Room Procedures in Chemical Hazard Emergencies: A Job Aid" can be found at the following website http://www.cdc.gov/nceh/demil/articles/initialtreat.htm

Obstacles that may delay recognition of chemical-related illness:

- non-specific symptoms similar to those of natural diseases
- nonexistent or mild immediate symptoms caused by certain chemicals having delayed health effects
- exposure through a distribution network resulting in cases occurring over a long period in different locations (e.g., contamination at food distribution hubs with subsequent transfer points involved)
- simultaneous intentional use of multiple chemical agents causing a mixed clinical presentation
- health care providers unfamiliar with infrequently seen chemical-related illnesses
- lack of patient recall of some chemicals and toxins (such as ricin) that are odorless, colorless, and tasteless — ideal for deliberate contamination of food or oral medication.

Adapted from: Centers for Disease Control and Prevention "Recognition of Illness Associated With Chemical Exposure" webcast http://www.phppo.cdc.gov/phtn/webcast/chemical-exp/ August 5, 2004; and Centers for Disease Control and Prevention. Recognition of Illness Associated With Exposure to Chemical Agents— United States, 2003. MMWR 2003;52:938-940 (http://www.cdc.gov/mmwr/preview/mmwrhtml/mm5239a3.htm).

Analysis of Clinical Samples for Agents of Chemical Terrorism at the IBL

The mission of the Centers for Disease Control and Prevention (CDC) - Laboratory Response Network (LRN) is to integrate laboratory capabilities across the country to allow for quick response to public health threats and emergencies, which may include emerging infectious diseases and biological or chemical terrorism. The Idaho Bureau of Laboratories (IBL) has been a biological agent reference laboratory in the LRN since 2000. In late 2003, the IBL began participation in a new focus area within the LRN, one that will ultimately give Idaho the ability to detect select chemical terrorism agents and metabolites in clinical samples.

In Idaho's LRN plan for clinical sample analysis following suspicion of chemical terrorism, hospitals and clinics collect a series of whole blood and urine samples according to available CDC guidance. The CDC "Rapid Toxic Screen" will analyze the specimens from up to 40 symptomatic patients. This series of tests looks for 150 chemical agents or metabolites with results within 36 hours after specimen receipt by the CDC. Samples from additional patients will be tested at state laboratories.

The IBL chemistry section is in the proficiency testing approval stages to analyze cyanide in blood and toxic metals in urine (*i.e.*, beryllium, cobalt, molybdenum, cadmium, antimony, cesium, barium, tungsten, platinum, thallium, lead, and uranium). These testing capabilities should be offered to healthcare providers in mid-2005. Tests slated to become available by the end of 2005 include additional chemical elements measured in clinical samples (including lead, cadmium, and mercury in blood) and new methods for measuring both nerve agent metabolites and cholinesterase levels (e.g., in association with pesticide exposures).

For detailed information on LRN clinical sample collection and shipping procedures, contact Dr. Ian Elder, IBL Chemical Terrorism Laboratory Coordinator, by e-mail at elderi@idhw.state.id.us or by phone at (208) 334-2235 x 269.

Reporting Poisonings

Case definitions for chemical poisoning were recently published by CDC in the MMWR. The citation is MMWR, January 14, 2005, 54 (RR01) 1-24, available at: http://www.cdc.gov/mmwr/PDF/rr/rr5401.pdf

Clusters of extraordinary or unexplained illness are reportable to your district or state health department. The health department can provide assistance with contacting appropriate law enforcement officials if an intentional poisoning is suspected.

Poison Control Centers

We encourage health care providers to also report cases of poisoning to a poison control center. The poison control center can be reached at 1-800-860-0620 (Idaho only) or 1-800-222-1222 (national). Callers will be connected to trained poison specialists who will record information and provide triage and case management recommendations. Call data is uploaded every 4–10 minutes to the national Toxic Exposure Surveillance System (TESS) which is used to detect sudden increases in case (or syndrome) frequency and severity on a temporal or regional basis that could indicate a chemical terrorism event. More information about TESS can be found at http://www.aapcc.org/ .
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